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ONTARIO MINISTRY OF ENVIRONMENT
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ALGAE COUNTERS' REVIEW

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Water n n Ontario

Ontario
Water Resources
Commission

Division
Of Laboratories
Biology Branch

ALGAE COUNTERS' REVIEW

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No. 5

December, 1970

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OUR NEW COVER DESIGN

You will note that the cover design of the Algae Counters' Review has been revised to incorporate the new OWRC Logoscript. The 'wave' and theme "Water Management in Ontario" have been introduced to have a readily identifiable symbol synonymous with the Ontario Water Resources Commission. In future all OWRC buildings, vehicles, boats, stationary, equipment and advertising will be labelled with the symbol.

The microscope and field view of the algae on a green background represent the Algae Identification and Enumeration Programme of the Biology Branch.

ALGAE COUNTING COURSES

The first Algae Identification and Enumeration Course was held at the Commission laboratory in 1963. Over the intervening years six more courses have been conducted. The two most recent courses were held in April, 1968 and March,1970. The next course will be held when we have acquired a list of ten candidates. Any individuals who wish to attend the course should contact Mr.Gordon Hopkins of the Biology Branch.

With regard to the most recent course, the manual was revised and updated. The manual now includes a lecture entitled "Limnological Aspects of Water Supplies" and an Appendix that provides a listing of algal forms identified from Ontario waters which are significant to sanitary scientists and water works operators.

On several occasions it has been mentioned that we would hold a more advanced course or seminar for those persons who have already attended the basic course. We are presently accumulating material and perfecting techniques which will comprise the substance for such a course.

The following persons attended the sixth course held in April, 1968:

Harold Hodgson, Niagara Falls
Wayne Manley, Peterborough
Gordon Gibson, Kingston
Robert Stewart, South Peel System (OWRC)
Ed Reed, Grand Bend (OWRC)
Doug Jerrard, Grand Bend(OWRC)
Vance Langford, St.Thomas(OWRC)
Steve Balkou, Metro Toronto, (R. C. Harris Plant)
Lloyd Wakelin, Lindsay
Larry Justus, Trent University Peterborough
Kornelius Reyneker, Sarnia
Sam Kozack, Arnprior
Cliff John, Sudbury
Jim Clarke, Division of Sanitary Engineering, OWRC

The following persons attended the seventh course in March, 1970:

Ken Jones,South Peel System(OWRC)
Joe Seeley, " " " "
David Middleton, Belleville
Miss Sharon Heard, Cornwall
Wayne Worden, Kingston
Harold Hodgson, Niagara Falls
David Gray, Oshawa
Les Sharfe, Ottawa
P. Sivilia, Metro Toronto
Burt Worth, Ontario Hydro

Mrs. Anne Borland,
  Division of Research, OWRC
John Westwood,
  Biology Branch, OWRC

This brings the total number of persons who have participated in the course to 69, representing 31 municipalities and seven OWRC plant operated water supply systems.

WHO'S COUNTING ALGAE AND WHERE?

A number of individuals have attended our algae courses for interest sake alone. Others have participated with the intention of establishing a regular algae counting programme; but, due to reasons such as double duties, lack of equipment and other priorities, have not been able to participate in a regular programme. At present we are receiving copies of algae reports or have access to data performed by the following water treatment plant operators:

Sharon Heard,
Lionel Lefebre,
  Cornwall.

Elmer Moore,
  Smiths Falls.

Wayne Manley,
  Peterborough.

Gordon Gibson,
Wayne Worden,
  Kingston.

David Middleton,
  Belleville.

Les Scharfe,
  Ottawa.

Gordon Ritchie,
Lloyd Wakelin,
  Lindsay.

Cliff Johns,
  Sudbury.

Kornelius Reyneker,
  Sarnia.

Annemarie Kuppe,
  Hamilton.

Harold Hodgson,
  Niagara Falls.

Alf Shingler,
  Cedar Springs Hospital,
  (Blenheim)

Stephen Balkou,
Wendell Mackinnon,
Peter Sivilia,
  Metro Toronto.

Joe Seeley,
Ken Jones,
  South Peel System (OWRC)

Owen McLaughlin,
  Dunnville Regional System,
  (OWRC)

Dave Standen,
Scott Baltzer,
  Union (OWRC)

Doug Jerrard,
  Grand Bend(OWRC)

Maurice Wilkinson,
  Goderich (OWRC)

HUMOUR!

A true music lover is one who, when he hears a beautiful blonde singing in the bathtub, puts his ear to the keyhole!

ALGAE COUNTING - WHAT PURPOSE?

In recent years the scope of the Commission's programme related to phytoplankton studies has been expanded to include an Algae Identification and Enumeration Course and a Phytoplankton Inventory Programme. The significance of these endeavours cannot be emphasized enough. In addition to documenting information on the biological quality of the water at a number of municipalities along the Great Lakes and from various inland waters, the aforementioned programmes are promoting a better understanding amongst water works operators of the significance of algae as they affect water treatment processes, and of the remedial measures that may be implemented to offset the algae- caused problems.

Mr. Wayne Manley of the Peterborough Water Treatment Plant has utilized his data as part of his public relations programme. Mr. Manley summarizes the standing stocks of phytoplankton and presents the results in pictorial form using the format outlined on pages 9, 10 and 11 of the Algae Counters' Review, Issue No. 4. The illustrations have been extremely popular and helpful in promoting a better understanding of algae, their growth patterns and related water treatment plant problems to the public in general.

Most individuals realize that the development of algae is related to a number of environmental, nutritional and physical factors. However, in many lakes and rivers throughout the Province artificial inputs of nutrients particularly phosphorus and nitrogen have increased the development of troublesome and obnoxious levels of algae. In the near future it is expected that nutrient removal facilities are to be effected at many, if not all, sewage treatment plants. The importance and significance of long-term "before-hand" phytoplankton data compiled by participants of our Phytoplankton Inventory Programme cannot be over-emphasized in providing an evaluation of the effectiveness of nutrient facilities.

QUICK QUIZ!

Do you know rural Ontario? Pinpoint each of the following municipalities by county or nearest urban centre. Answers are on page 4.

1. Tilbury ....
2. Tiverton ....
3. Teeswater ....
4. Tavistock ....
5. Tottenham ....
6. Thedford ....
7. Teeterville...............
8. Thorndale ....
9. Tatlock ....
10. Thornton ....
11. Thornbury ....
12. Tara ....

Don't turn the page yet!

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Answers to QUICK QUIZ!

	County	Urban Centre
1.	Kent	Chatham
2.	Bruce	Owen Sound
3.	Bruce	Goderich
4.	Oxford	Stratford
5.	Simcoe	Orangeville
6.	Lambton	Sarnia
7.	Norfolk	Simcoe
8.	Middlesex	London
9.	Lanark	Arnprior
10.	Simcoe	Barrie
11.	Grey	Owen Sound
12.	Bruce	Owen Sound

Score:

12 -	Genius (Run for Prime Minister)
10 - 11	Very Good (Run for M.P.)
5 - 9	Average (Run for M.P.P.)
2 - 4	Poor (Don't enter politics)
<2	Keep counting algae!

RECENT BIOLOGY BRANCH PUBLICATIONS

Since the last issue of the Algae Counters' Review, we have been pushing our pencils diligently and have published a number of articles and reports which may be of interest to persons involved in our algae counting programmes. These reports are as follows:

1. Algae Identification and Enumeration Course Manual. Biology Branch, OWRC. Revised March, 1970.

2. Phytoplankton Levels in Canadian Near-shore Waters of the Lower Great Lakes. Proc. 11th Conf. Great Lakes Res. 1968.

3. Planktonic and Periphytic Algae of the Great Lakes. Great Lakes Institute Report. PR.39, U.of T., 1969.

4. Effects of Acid Mine Wastes on Phytoplankton Communities of Two Northern Ontario Lakes. Journ. Fish Res. Bd. Canada. 27: 1969.

5. Investigations of Daily Variations in Chemical, Bacteriological and Biological Parameters at Two Lake Ontario Locations near Toronto. Three parts Proc. 12th Conf. Great Lakes Res. 1969.

6. Long Term Changes in Water Chemistry and Abundance of Plankton at a single sampling location in Lake Ontario. Proc. 8th Conf. Great Lakes Res. 1965.

7. Biology Branch Reports on Surveys involving algae problems.

a) Biological Survey of Little Lake Panache, 1968.

b) Biological Survey of Riley Lake, 1968.

c) Water Quality Evaluation of Bernard Lake, 1969.

d) Phytoplankton Conditions in Mooney's Bay and Dows Lake, 1969.

e) Status of Enrichment in Silver Lake, 1969.

8. Cottagers and Water Pollution. Address delivered to Ontario Branch of the Canadian

Institute of Pollution Control. 1970.

9. Biological Aspects of Water Management. OWRC Biology Br., 1970.

10. Enrichment of Precambrian Lakes. Biology Br., 1970.

Over the past few years a tremendous amount of interest and concern has been expressed and generated by the public relative to pollutional problems in recreational lakes. Owing to our Branch's involvement in this problem we are taking the liberty of providing you with the article entitled "Enrichment of Precambrian Lakes". This article was prepared as a release to inform the public of the causes of nutrient enrichment, of the relationship between detergents and excessive algal and vascular aquatic production, of the studies currently underway by the OWRC and something of the preventative measures which can be effected by individual cottagers and householders until a clear definition of the required facilities or practises essential to prevent artificial nutrient additions and/or bacterial contamination is provided.

MORE HUMOUR!

Who was it that said, "Old age is when you get a gleam in your eye only when the sun hits your bifocals?"

DIFFICULT IDENTIFICATIONS

Are you having trouble identifying some of the microscopic organisms you see? If so,we can be of some assistance even though we may not get a chance to look at the sample. The first question to ask yourself is,"Are there many of the unknown organisms present?" If you only see one or two organisms in a sample, don't waste time searching for a name. It may be an oddity but it won't affect your water supply. If there are a large number of unidentifiable forms the following process of elimination may be helpful.

Key:

1. a. Animal forms (2-6)
   b. Plant forms (7-10)
   c. Detritus

2. a. visible to naked eye (3)
   b. invisible to naked eye (6)

3. a. Multicelled organisms - individuals probably greater than 100 microns, motile. (4)

   b. Multicelled organisms - attached and/or non-motile, colonial (5)

4. a. Motility due to presence of appendages, i.e. legs or antennae, i.e. *Microcrustaceans*.

   b. Motility due to body movements, i.e. *worms*, *insect larvae*, *hydra*, *flat-worms*, *round worms*, *coelenlerates*.

5. a. Clear, Spindle or needle-shaped spicules - *fresh water sponges*.

b. egg shaped organisms, brown with black centres, microscopic hooks or anchors. Bryozoa (statoblasts).

6. a. single-celled, no distinct organization of internal-structure into organs. Protozoa.

b. multicelled but microscopic, possessing rudementary body parts such as mouth parts or head, digestive tract, circulatory system. Rotifers.

7. a. Visible to naked eye in filaments, mats or globlose bundles. (8)

b. Individual cells invisible to naked eye but sample colour is green, red or brown in appearance. (10)

8. a. Filaments or mats are probably Green or Blue-green algal filaments.

b. Globlose bundles - bluish-green, floating, probably colonial Blue-greens. (9)

9. a. Internal cell structure lacking or indistinct - Blue-greens.

b. Highly organized internal structure - Greens.

10. a. Green suspension throughout sample - Greens, Flagellates.

b. Brown or yellowish-brown or green, settles to bottom of sample - Diatoms, Flagellates.

c. Reddish-green - Flagellates, Greens.

If you get this far without some insight and are not as yet completely frustrated, call it an unknown and number it according to the aforementioned key (i.e. Unknown - 4a). Make a large diagram (at least ¼ page in size) measure the overall dimensions (and length of appendages if present), describe the colouring and submit this diagram with the algae report form. We will try to complete the identification and inform you of our discovery. If sufficient organisms are present, send us a sample; this would greatly facilitate the identification. Best of Luck!!

REPORT FORMS AVAILABLE

In addition to the Bench Sheets and Plankton Enumeration Sheets which are available on request we now have blank annual report forms (graphs) available. The use of this form facilitates the assessment of the annual cyclic pattern of algae populations if you have been conducting regular weekly counts. The details of how to use this form were outlined in the last issue of this review.

STILL MORE HUMOUR!

An official of the employees association in the hospital with a heart condition received the following card: "Branch 172 of the Water Works Operators' Assoc. wishes you a speedy recovery by a vote of 118-56".

TEST SAMPLE RESULTS

Introduction

The accuracy of an algae count depends to a large extent on the techniques and skills employed by the individual analyst. In order to assess the degree of analytical variation that exists among operators trained under standardized procedures, it was decided in 1966 that a test sample be prepared and sent to ten water works involved in the Phytoplankton Inventory Programme. The results of this work were presented in the March 1967 edition of the Algae Counters' Review. Late in 1967 a second test sample was prepared and forwarded to eleven water treatment plants. The following outlines the results of this study.

Methods

The test sample which was prepared by personnel of the Biology Branch included a variety of both common and uncommon phytoplanktonic types. Thus, the test sample was designed specifically to tax the skill of each participant. From an original "well-mixed" sample, a number of aliquots were drawn off and forwarded to the various participants.

Individuals were asked to examine quantitatively and qualitatively three separate aliquots after concentrating by means of the Sedgwick-Rafter sand filtration technique. Additionally, it was suggested that a single unconcentrated aliquot be examined. Analytical procedures followed were those taught during the Algae Identification and Enumeration Courses.

Six individuals from the Biology Branch served as referees for the test.

Results

In total, 84 counts were completed, 24 by the 6 referees and 60 by 20 participating individuals. In all 97 genera were identified; 88 by the water treatment plant operators and 65 by the referees. Table I(page 10)provides a breakdown of the reported genera. For example, Melosira and Asterionella were seen in 81 of the 84 samples counted, while 25 genera occurred as single observations.

An average total of 564 a.s.u. per ml was obtained from the 24 counts completed by the judges. A breakdown by municipality of the quantitative results is reported in Table II(page 12). To compare your counts with those obtained by the judges refer to the referees MEAN count.

Discussion

Any natural body of water tends to have many forms of life. The common forms are readily identified while others are rarely encountered. Assuming no errors were made in identification, it may be concluded that a continuing study of a given sample tends to reveal more and more types. It has been estimated (Preston, 1948) that if a study of a particular sample were continued long enough, as many as 125 genera might eventually be identified.

A few genera reported by the water treatment plant operators were not identified by the referees. A number of reasons may account for this apparent discrepency. First, each water treatment plant operator is

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concerned primarily with the planktonic flora of his limited region. Occasionally, a participant would recognize an algal form not familiar in some areas of Ontario but present in his own. Second, actual occurrences of rare algal types undoubtedly prevailed. These occurrences were identified correctly by the analyst but were not encountered by other participants or referees. Third, misidentification is a distinct possibility when a large number of analysts examine unfamiliar samples. For example, the filamentous green alga Ulothrix was observed in 20 counts - all completed by participating water treatment plant operators. However, this alga was not identified in any of the samples analyzed by the referees. Past experiences (Schenk and Thompson, 1965) have indicated that many individuals commonly misidentify the filamentous diatom Melosira as Ulothrix.

Quantitatively, relatively consistent results were recorded among the participants. However, it was apparent that minor variations in total a.s.u. values existed from one analyst to the next. These variations may be attributed to the relative scarcity of plankton in the test sample, to the number of new individuals counting and/or to the differences in numbers of cells identified and enumerated by the various participants. For example, some analysts counted only ¼ strip of a concentrated sample while others counted 2-4 strips of a similar concentrate. As a rule of thumb counting should be carried out until at least 100 individuals of the 3 or 4 most important species have been enumerated.

Some of the variability apparent in Tables I and II is attributable to the nature of the test sample. This sample was prepared by combining samplings from several lakes throughout the Province. With a prepared or artificial batch it is obvious that there will be a random distribution of species as the flora will not be controlled by a specific set of regulating environmental, physical and chemical factors. If the test sample originated from a single sampling site (i.e. a natural population), the total number of species would be limited by the aforementioned factors. This would result in a lower number of so-called "rare species".

Perhaps a much more rewarding approach, at least from the viewpoint of unifying identifications would be to have participants analyze the same natural sample.

Of particular significance is the fact that total a.s.u. counts were 23-55% lower when samples were concentrated with the Sedgwick-Rafter funnel, owing mainly to the loss of the small fragile green and flagellated algae. Preservation and concentration with Lugol's Iodine (see November 1967 issue of Algae Counters' Review) would undoubtedly reduce the loss and fragmentation of these smaller, more delicate forms. The next test sample we prepare will involve concentration using Lugol's Solution.

Summary

The study revealed that waterworks operators trained in standard techniques obtain relatively consistent results. The value and importance of a standardized programme cannot be overestimated. It enables the exchange of information among laboratory and water treatment plant personnel and promotes a better understanding amongst waterworks operators of the significance of algae as they affect water treatment plant processes.

THE GENUS EUGLENA

A few facts concerning *Euglena* from '*The Genus Euglena*' by Mary Gojdics, University of Wisconsin Press, 1953.

The genus *Euglena* is one of the connecting links between animal and the plant kingdom. Euglenae - a basic form - are practically the same the world over, and are a classic form used in the study of elementary botany and zoology. Mary Gojdics has spent over 20 years studying this genus.

- To date there are almost 300 species and varieties of *Euglena*.

Habitat: *Euglena* have been found on the bark of the honey locust; in the bladders of Uticularia (an aquatic plant); on river banks; on snow in sufficient numbers to make it appear green; on the soil in flower pots; on the mucosa of tadpoles; in lakes, streams, ponds, swamps and rain-water pools.

Size: *Euglena* ranges in size from 12 x 15 microns for *E. minuta* to 530 x 40 microns for *E. oxyuris*.

Shape: The greatest number of *Euglena* species are spindle-shaped, with the anterior end rounded and the posterior end extended to a pointed tailpiece (not to be confused with the flagellum which is at the anterior end). The cell can change with movement and become spherical.

Colour: Most species of *Euglena* have only the green colour of their chlorophyll, but about a dozen species have a red pigment, haematochrome which lies near the central axis in dim light and migrates toward the cell surface in bright light. If *E. haematodes* are moved from shade to good sunlight, their apparent colour changes from green to red within five minutes. *E. rubra* turned from red to green within fifteen minutes due to the presence of cloud cover. It has been suggested by Gojdics and others that the red pigment protects the cells from excessive heat and light. Many reports state that "bloom" conditions of species containing haematochrome have turned water surfaces blood red. One of the earliest recordings was from biblical times. (Exodus 7: 20, 21.)

Flagellum and Locomotion: *E. viridis* which has a flagellum 128 microns long (twice its body length) was measured with a high speed movie camera by A.G.Lowndes (1936-47). It moves forward at an angle of 30° to the line of direction at a speed of 168 microns per second by vibrations which moved from the base to the tip of the flagellum at a rate of 813 microns per second. This

(continued on page 11)

Table I. Species Identified From Test Sample.

A* number of samples in which referees encountered this genus;

B* number of samples in which water treatment plant operators encountered this genus;

C* total number of samples in which this species was encountered (Maximum number - 84).

	A*	B*	C*		A*	B*	C*
			Blue-green algae				
Anabaena	7	19	26	*Lyngbya*	20	8	28
Anacystis	11	33	44	*Merismopedia*	-	1	1
Aphanizomenon	14	11	25	*Microcoleus*	-	1	1
Aphanocapsa	1	1	2	*Microcystis*	9	5	14
Aphanothece	2	-	2	*Nodularia*	-	1	1
Chroococcus	6	1	7	*Nostoc*	-	4	4
Coelosphaerium	-	1	1	*Oscillatoria*	19	41	60
Gomphosphaeria	7	16	23	*Polycystis*	1	-	1
				Rhabdoderma	1	-	1
			Green algae				
Actinastrum	3	6	9	*Microspora*	-	4	4
Ankistrodesmus	18	26	44	*Mougeotia*	10	7	17
Aphanochaete	-	1	1	*Nephrocytium*	1	-	1
Arthrodesmus	1	-	1	*Oocystis*	14	11	25
Chaetophora	-	1	1	*Palmella*	-	6	6
Characiopsis	-	3	3	*Pediastrum*	13	35	48
Chlorella	3	24	27	*Planktosphaeria*	1	-	1
Chlorococcum	6	6	12	*Phytoconis*	-	2	2
Closteriopsis	-	2	2	*Scenedesmus*	18	30	48
Closterium	5	4	9	*Schroederia*	11	2	13
Coelastrum	6	9	15	*Selenastrum*	-	2	2
Cosmarium	2	5	7	*Sorastrum*	-	1	1
Crucigenia	2	3	5	*Sphaerocystis*	1	7	8
Dictyosphaerium	13	2	15	*Spirogyra*	-	12	12
Dimorphococcus	1	-	1	*Tetraedron*	4	-	4
Echinosphaerella	1	-	1	*Treubaria*	1	-	1
Elakatothrix	-	1	1	*Tribonema*	-	3	3
Franceia	5	-	5	*Tetradesmus*	3	-	3
Golenkinia	2	1	3	*Tetraspora*	-	2	2
Kirchneriella	5	-	5	*Ulothrix*	-	20	20
Lagerheimia	1	2	3	*Zygnema*	-	2	2
Micractinium	3	4	7				
			Flagellated algae				
Ceratium	4	12	16	*Mallomonas*	1	-	1
Chlamydomonas	21	23	44	*Pandorina*	-	1	1
Cryptomonas	17	-	17	*Peridinium*	9	19	28
Dinobryon	5	6	11	*Phacus*	1	4	5
Eudorina	5	-	5	*Synura*	5	3	8
Euglena	1	9	10	*Trachelomonas*	7	6	13
Gymnodinium	1	-	1	*Uroglena*	-	1	1
Lepocinclis	-	1	1	*Volvox*	-	1	1

...continued

Table I continued....

Diatoms

	A*	B*	C*		A*	B*	C*
Actinocyclos	-	4	4	Gyrosigma	-	2	2
Asterionella	24	57	81	Melosira	24	57	81
Cocconeis	-	2	2	Meridion	-	3	3
Cyclotella	14	37	51	Navicula	1	15	16
Cymatopleura	-	1	1	Nitzschia	3	-	3
Cymbella	3	4	7	Pinnularia	-	1	1
Diatoma	16	2	18	Rhizosolenia	-	3	3
Fragilaria	20	38	58	Stephanodiscus	18	23	41
Frustulia	-	1	1	Surirella	1	2	3
Gomphonema	1	4	5	Synedra	23	39	62
				Tabellaria	5	23	28

The genus Euglena - continued..

caused the flagellum to beat at 12.7 times per second.

The Eyespot:

- The eyespot (3-10µ in size) is located at the base of the flagellum and is made up of a colourless matrix embedded with red granules. It does not contain a lens like a true eye. Its photosensitive properties are closely associated with the flagellar swelling at the base of the flagellum.

STILL MORE HUMOUR!!

Nurse to father waiting in maternity ward:

"Well, did you want a boy or a girl?"

"A boy"

"Well, I'm afraid it's a girl!"

"That's O.K., that was my second choice."

Table II. Quantitative Results of Test Sample.

Municipality	Blue Greens	Flagellates	Greens	Diatoms	TOTAL
	expressed as a.s.u. per millilitre				
Referees					
Maximum	248	351	110	789	976
Minimum	25	2	1	93	271
MEAN	91	63	37	373	564
Hamilton					
Maximum	284	115	75	294	392
Minimum	47	0	11	30	154
Mean	120	51	30	133	334
Smiths Falls					
Maximum	35	19	6	196	201
Minimum	7	5	0	154	237
Mean	22	12	3	180	217
Peterborough					
Maximum	424	503	100	169	1256
Minimum	27	99	2	79	235
Mean	178	263	35	133	609
Union #1					
Maximum	303	149	63	516	919
Minimum	174	14	0	227	415
Mean	251	75	23	388	736
Union #2					
Maximum	312	60	160	690	1163
Minimum	70	26	12	277	461
Mean	155	30	70	416	671
Union #3					
Single Count	87	41	168	385	680
Metro Toronto					
Single Count	50	63	–	131	245
Lindsay #1					
Maximum	122	135	8	969	1091
Minimum	23	0	0	179	238
Mean	71	57	2	492	621

continued...

Table II continued....

Municipality	Blue Greens	Flagellates	Greens	Diatoms	TOTAL
	expressed as a.s.u. per ml.				
Lindsay #2					
Maximum	134	58	19	425	531
Minimum	49	46	0	248	446
Mean	99	51	6	332	488
Cornwall					
Maximum	88	102	26	370	572
Minimum	69	29	10	229	377
Mean	80	74	16	283	453
Dunnville					
Maximum	172	140	54	804	1042
Minimum	71	56	33	295	556
Mean	113	103	42	517	775
Kingston #1					
Maximum	105	93	12	173	327
Minimum	25	34	2	130	256
Mean	66	69	8	151	294
Kingston #2					
Maximum	28	57	23	143	214
Minimum	6	36	5	104	210
Mean	18	47	15	127	205
Trent University					
Maximum	101	352	35	1327	1600
Minimum	12	227	24	626	1103
Mean	53	269	31	993	1346
Goderich					
Maximum	215	206	34	473	702
Minimum	48	25	0	203	449
Mean	133	78	19	353	583
Cedar Springs #1					
Maximum	66	74	0	745	819
Minimum	0	0	0	70	136
Mean	32	29	0	323	384
Cedar Springs #2					
Maximum	17	19	0	153	158
Minimum	0	0	0	94	127
Mean	10	17	0	124	152

continued...

Table II. continued...

Municipality	Blue Greens	Flagellates	Greens	Diatoms	TOTAL
	expressed as a.s.u. per ml.				
Cedar Springs #3					
Maximum	115	86	18	197	428
Minimum	91	84	0	226	390
Mean	103	85	9	212	409
Cedar Springs #4					
Single Count	0	136	0	158	294
Cedar Springs #5					
Single Count	26	222	0	78	326

Season's Greetings

FROM THE PHYTOPLANKTON SECTION

BIOLOGY BRANCH, OWRC

M. P. Michalski
Mary Jonker
Ivy Wile

Gordon J. Hopkins
Elaine Durrant.
Charmaine [illegible]
Glenn Robinson

Carl Schenk
Ruth Higginson
Kathy McDonald.

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